

Fig. 4 is block diagram of a point-to-multipoint wireless access system according to a fourth embodiment of the present invention.

## PREFERRED EMBODIMENTS OF THE INVENTION

5 The present invention provides a point-to-multipoint wireless access system that can be used in the case where the usable frequency band is narrow so that a broadband transmission is not suited or where a low-cost, high-speed transmission is desired.

More specifically, the point-to-multipoint wireless access system according to a preferred embodiment of the present invention has a combination of:

- (1) a high-frequency band and a low-frequency band;
  - (2) a licensed frequency band and a non-licensed frequency band; or
  - (3) an optical communication band and a wireless communication band,
- 15 in a down-link channel, i.e., a channel from a wireless base station to a wireless subscriber's terminal, and an up-link channel, i.e., a channel from a wireless subscriber's terminal to a wireless base station.

In a more concrete example, the point-to-multipoint wireless communication system of the present invention uses a combination of two  
20 different frequency bands including a sub-millimeter waveband or a millimeter waveband such as 26GHz, 28GHz, 38GHz and 42GHz bands, and a non-licensed frequency band such as a 2.4GHz ISM, 5.3GHz, or 60GHz frequency band or an optical communication band. The term "non-licensed band" as used herein means that a license from the Ministry of  
25 Posts and Telecommunications is not needed.

In a wireless access system according to a preferred embodiment of the present invention, the down-link channels for the subscriber's terminals use a frequency band corresponding to a sub-millimeter waveband or a millimeter waveband, such as 26-GHz, 28-GHz, 38-GHz or 42-GHz band, and the up-link channels for the subscriber's terminals use a 2.4-GHz ISM band; the down-link channels use a 5.3-GHz frequency band and the up-link channels use a 2.4-GHz ISM band; the down-link channels use a 60 GHz frequency band and the up-link channels use a 5-GHz frequency band; or the down channels use the sub-millimeter waveband or the millimeter waveband, such as 26-GHz, 28-GHz, 38-GHz and 42-GHz frequency bands, and the up-link channels use an optical wave.

In the above configuration, the higher-frequency band is used for the channel transmitting larger capacity data, whereas the lower-frequency band is used for the channel transmitting smaller capacity data. By using the above frequency bands in both the up-link and down-link channels, a low-cost, high-speed point-to-multipoint wireless communication system can be realized.

Now, the present invention is more specifically described with reference to accompanying drawings, wherein similar constituent elements are designated by similar reference numerals.

Referring to Fig. 1, a wireless access system according to a first embodiment of the present invention is such that the down-link channel from the wireless base station to the subscriber's terminal uses a frequency band corresponding to a sub-millimeter waveband or millimeter

waveband, such as 26-GHz, 28-GHz, 38-GHz, and 42-GHz frequency band, and the up-link channel from the subscriber's terminal to the wireless base station uses an 2.4-GHz ISM band that does not need a license from the authority. The wireless access system of the present embodiment is used as a point-to-multipoint access system which transmits large capacity data through the down-link channel and transmits small capacity data through the up-link channel. The wireless access system of the present embodiment can be constructed at a lower cost, and effectively operate at a high speed.

More specifically, the wireless access system of Fig. 1 includes a wireless base station 11 connected to a communication network or backbone network 13, a plurality of user's terminals 24, and a plurality of wireless subscriber's terminals  $12_1$  to  $12_N$  to which the respective user's terminals 24 are connected through the user's Ethernet. The user's terminal may be a personal computer.

The down-link channel from the wireless base station 11 to each of the wireless subscriber's terminals  $12_1$  to  $12_N$  is connected through a wireless communication system using a wireless frequency band corresponding to a sub-millimeter waveband or millimeter waveband, such as 26-GHz, 28-GHz, 38-GHz, and 42-GHz frequency bands. The up-link channel from each of the wireless subscriber's terminal  $12_1$  to  $12_N$  to the wireless base station 11 is connected through a wireless communication system using a 2.4-GHz ISM band. The communication network 13 is connected through an internet service provider (ISP) 14 to the Internet 15, to which a user server 28, such as a content server, having